

CLAIMS

1. A method of time-scale modification processing of frame-based digital audio signals wherein, for each frame of predetermined duration:

5 the original frame of digital audio is copied;
the original and copied frames are partly overlapped to give a desired new duration to within a predetermined tolerance;

the extent of overlap is adjusted within the predetermined tolerance by reference to a cross correlation determination of the best match between the
10 overlapping portions of the original and copied frame; and

a new audio frame is generated from the non-overlapping portions of the original and copied frame and by cross-fading between the overlapping portions;

characterised in that a profiling procedure is applied to the overlapping portions of the original and copied frame prior to cross correlation, which
15 profiling procedure reduces the specification of the respective audio frame portions to respective finite arrays of values, and the cross correlation is then performed in relation only to the pair of finite arrays of values.

2. A method as claimed in Claim 1, wherein for the said overlapping
20 portions the profiling procedure identifies periodic or aperiodic maxima and minima of the audio signal portions and places these values in said respective arrays.

3. A method as claimed in Claim 2, wherein the overlapping portions
25 are each specified in the form of a matrix having a respective column for each audio sampling period within the overlapping portion and a respective row for each discrete signal level specified, and the cross correlation is applied to the pair of matrices.

30 4. A method as claimed in Claim 3, wherein a median level is specified for the audio signal level, and said maxima and minima are specified as positive or negative values with respect to said median value.

5 5. A method as claimed in Claim 3, wherein prior to cross correlation, at least one of the matrices is converted to a one-dimensional vector populated with zeros except at maxima or minima locations for which it is populated with the respective maxima or minima magnitude.

10 6. A method as claimed in Claim 1, wherein the predetermined tolerance within which the overlap between the original and copied frames may be adjusted is based on the pitch period of the audio signal for the original frame.

15 7. A method as claimed in Claim 4, wherein the maxima or minima are identified as the greatest recorded magnitude of the signal, positive or negative, between a pair of crossing points of said median value.

20 8. A method as claimed in Claim 7, wherein a zero crossing point for said median value is determined to have occurred when there is a change in sign between adjacent digital sample values.

25 9. A method as claimed in Claim 7, wherein a zero crossing point for said median value is determined to have occurred when a signal sample value exactly matches said median value.

30 10. A digital signal processing apparatus arranged to apply the time scale modification processing method of Claim 1 to a plurality of frames of stored digital audio signals, the apparatus comprising storage means arranged to store said audio frames and a processor programmed, for each frame, to perform the steps of:

 copying an original frame of digital audio and partly overlapping the original and copied frames to give a desired new duration to within a predetermined tolerance;

 adjusting the extent of overlap within the predetermined tolerance by

applying a cross correlation to determine the best match between the overlapping portions of the original and copied frame; and

generating a new audio frame from the non-overlapping portions of the original and copied frame and by cross-fading between the overlapping portions;

- 5 characterised in that the processor is further programmed to apply a profiling procedure to the overlapping portions of the original and copied frame prior to cross correlation to reduce the specification of the respective audio frame portions to respective finite arrays of values, and apply the cross correlation in relation only to the pair of finite arrays of values.

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